

Investigation on Cement Concrete at Mixed With Egg Shell Powder

Divya B¹, Vasanthavalli K², Ambalavanan R³

PG Student, Department of Civil Engineering, Periyar Maniammai University, Vallam, Thanjavur, Tamilnadu, India ¹.

Assistant Professor, Department of Civil Engineering, Periyar Maniammai University, Vallam, Thanjavur,
Tamilnadu, India ².

Professor, Department of Civil Engineering, Periyar Maniammai University, Vallam, Thanjavur,
Tamilnadu, India ³.

ABSTRACT: The eggshell usually which are disposed, is used as an alternate for the cement since the shell is made up of calcium. When the calcium carbonate is heated a binding material calcium oxide (lime) is obtained. The chemical parameters and compressive strength of concrete cubes was determined. The concrete mix proportion is 1:1.5:3 in which cement is partially replaced with eggshell powder as 5%, 10%, 15%, 20% by weight of cement. The compressive strength was determined at curing of 7 and 28 days

KEYWORDS: Egg Shell Powder (ESP); Concrete; Compressive strength.

I. INTRODUCTION

The eggshell also creates some allergies, when kept long time in garbage and disposal of eggshell also one the biggest problem. It also create undesirable smell which can cause irritation. The main ingredient in eggshells is calcium carbonate (the same brittle white stuff that chalk, limestone, cave stalactites, sea shells, coral, and pearls are made). The shell itself is about 95% CaCO₃ (which is also the main ingredient in sea shells). The remaining 5% includes Magnesium, Aluminium, Phosphorous, Sodium, Potassium, Zinc, Iron, Copper, Ironic acid and Silica acid. Eggshell has a cellulosic structure and contains amino acids.

Concrete is a composite material, Main ingredient of concrete is cement and it is one of the three primary producers of carbon-di-oxide. The carbon-di-oxide emission acts as a silent killer in the environment at various forms. In this backdrop the search for cheaper substitute to ordinary Portland cement is needed. To examine the feasibility of utilising the eggshell as cement replacement material. To study the eggshell mixed concrete specimen compared to the conventional concrete specimens. The main scope of this study is to cast concrete cubes and conduct the compressive strength for 7th and 28th day strength. In this project M20 grade is designed for various mix proportions.

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Processing of eggshell waste



Fig 1 - Processing of eggshell waste

II. EXPERIMENTAL PROGRAM

Material used

Ordinary Portland cement of 43 grade cement conforming to IS : 8112 was used. Locally available fine aggregate and coarse aggregates are used. Fine aggregate conforming zone II according to IS 383. According to IS 383 a well graded coarse aggregate was used in this project. Eggshell waste are collected from nearby government school and Periyar Maniammai University ladies hostel. In this project eggshell peeled out of boiled eggs. The collected eggshell is washed and heating upto 1800C for 24 hours using hot air oven. After that the eggshell is cooled using designator and grinded eggshell is sieved using 90 micron sieve size. Tap water is used for mixing and curing of concrete specimens. Table 1 shows the properties of materials.

Table 1 - Properties of materials

Test No	Description	Result
1.	Specific gravity of cement	3.01
2.	Fineness modulus of cement	7.6
3.	Initial setting time of cement	32min
4.	Specific gravity of fine aggregate	2.64
5.	Specific gravity of coarse aggregate	2.71
6.	Fineness modulus of fine aggregate	2.9
7.	Specific gravity of eggshell powder	1.20

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Mix proportioning

M20 grade concrete was used for in this mix proportion. The mix was designed as per IS 10262 – 1982 . The mix ratio is 1:1.5:3. Table 4 shows the mix proportioning of m20grade concrete. Table 2 shows the mix proportioning of M20 grade.

Table 2 - Adopted mix proportion

Mix	Cement	Eggshell	Fine aggregate	Coarse aggregate	Water	W/C
M1	383.2	0	627.26	1137.56	191	0.5
M2	364.04	19.16	627.26	1137.56	191	0.5
M3	344.8	38.32	627.26	1137.56	191	0.5
M4	325.72	57.48	627.26	1137.56	191	0.5
M5	306.56	76.64	627.26	1137.56	191	0.5

Experimental work

The experimental investigation consisted by varying percentage of eggshell powder as partially replaced with ordinary Portland cement 43 grade. The percentage of eggshell was varied by 5% , 10% , 15% , and 20%. The concrete cubes of 150 X 150 X 150 mm cubes was tested. The compressive strength of 7days and 28days strength was determined.



(a) (b)
Fig.2 (a) compressive strength test (b) Titration Method

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Chemical analysis of ESP

Using titrative method , the percentage of calcium present in the eggshell powder was found to be 74%

Table 3 - Compressive Strength

S.No	% of ESP added	7 - day strength (N/mm ²)	28 - day strength (N/mm ²)
1.	0	14.26	23.06
2.	5	14.87	24.16
3.	10	14.98	24.90
4.	15	15.09	25.06
5.	20	14.09	24.23

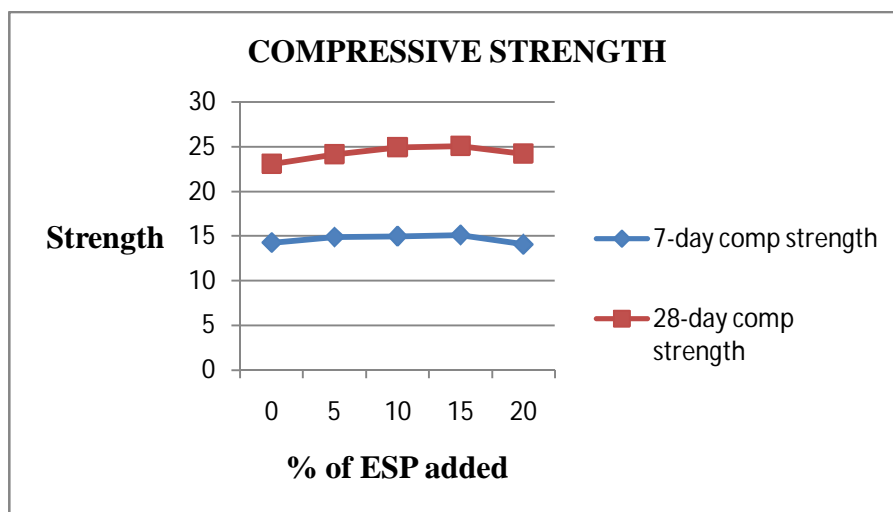


Fig 3 - Graphical representation of Compressive strength

III. CONCLUSION

In this paper the effect of eggshells on physical properties of concrete specimen was investigated.

- Replacement of 5% and 10% of ESP results in increase of about 4% in 28 – day compressive strength.
- Replacement of 15% of ESP results in increase of about 8% in 28-day compressive strength.
- Further increases in replacement (20%) results in decrease of compressive strength by about 4%.
- A recommended replacement is 15%.



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